TEXSCAN
HS-70

OPERATING AND INSTRUCTION MANUAL

MODEL HS-70

SWEEP GENERATOR

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SECTION 1

SPECIFICATIONS

1.1	SWEEP FREQUENCY RANGE	18 MHZ to 104 MHZ
1.2	CENTER FREQUENCY	Continuously variable from 20 MHZ to 100 MHZ
1.3	POWER OUTPUT	
	1.3.1 Attenuator Out	
	1.3.1.1 Sweep Mode	4 watts peak
	1.3.1.2 Modulated Sweep	4 watts peak
	1.3.1.3 CW Mode	2 watts
	1.3.1.4 Modulated CW	2 watts peak
	1.3.2 Attenuator In	
	1.3.2.1 Sweep Mode	2 watts peak
	1.3.2.2 Modulated Sweep	2 watts peak
	1.3.2.3 CW Mode	1 watt
	1.3.2.4 Modulated CW	1 watt peak
1.4	SWEEP WIDTH	0.1% to 15%
1.5	DISPLAY LINEARITY	1.2:1 over mid-80% of trace
1.6	ATTENUATION	
	1.6.1 Attenuator Out	0-3 db Vernier
	1.6.2 Attenuator In	3 to 83 db in 1 db Steps
1.7	FLATNESS	$\pm$ 0.5 db
1.8	OUTPUT IMPEDANCE	50 ohm
1.9	SWEEP RATE	50/60 HZ Line Rate
1.10	OSCILLOSCOPE HORIZONTAL DRIVE	Approximately 14 volts peak to peak
1.11	SOURCE VSWR	Approximately 1.2:1
1.12	INTERNAL MODULATION	An internal 1 KHZ square wave can be used to modulate the Sweep and CW Signals.

1.13	MARKER SYSTEM	Birdy-by-pass marker system.
	1.13.1 Internal	Provision for up to six single frequency (SM) or harmonic (HM) plug-in markers.
	1.13.2 External	An external CW signal of at least 50 mv may be used to produce a birdy marker.
1.14	POWER CONSUMPTION	115v or 230v AC 50/60 HZ Approximately 100 watts
1.15	SIZE	17" x 17" x 8-3/4"
1.16	WEIGHT	Approximately 50 lbs.

SECTION 2

GENERAL DESCRIPTION

2.1 GENERAL INFORMATION

The Texscan HS-70 sweep generator is a high power, wide tuning range unit which provides 4 watts of leveled output over the frequency range of 20 MHZ to 100 MHZ and offers a choice of four modes of operation: Swept RF, Modulated Swept RF, CW, and Modulated CW.

All circuits utilize silicon transistors except the high voltage circuits which utilize vacuum tubes and are conservatively designed. The elimination of vacuum tubes wherever possible has added to the reliability and life of the instrument, minimizing the maintenance required. The unit contains a built-in attenuator which enables the user to adjust the output signal from 0 to 83 db.

The unit has provisions for accepting up to six single frequency or harmonic plug-in markers for accurate frequency identification.

This unit finds wide application in testing and aligning high power, non-linear circuitry such as varactor frequency multipliers and high power transmitters. Also it can provide sufficient power to drive a multitude of test stations or an extremely lossy system.

2.2 INTRODUCTION

As shown in the block diagram, figure 2-1, the Model HS-70 consists of six major sections: (1) RF Oscillator, (2) Blanking and 1 KHZ Modulation Circuitry, (3) Automatic Leveler, (4) Horizontal Generator and Linearity Circuitry, (5) Power Supply, and (6) Birdy-By-Pass Marker Circuitry. The following paragraphs present a description of the circuit details of each of these sections.

2.3 RF OSCILLATOR

The RF Oscillator is a version of the series-fed Hartley oscillator utilizing a 3CX100A5 planar triode as the active element. The oscillator center frequency is varied by mechanically shorting sections of the two coils, L504 and L505, which make up the inductive half of the oscillator resonant circuit. The oscillator is swept at line frequency by the incorporation of a voice coil or "wobbulator" driven capacitor, C500, which makes up the other half of the resonant circuit. The wobbulator drives a machined aluminum block up and down between mating aluminum blocks connected to the plate and grid electrodes of the oscillator triode, V500. By varying the distance between these blocks, the capacitance changes and varies or sweeps the oscillator frequency about the center frequency which is determined by the number of sections shorted out on coils L504 and L505 and the rest position of the capacitor, C500. In the CW modes of operation the drive voltage is removed from the wobbulator and the oscillator becomes a tunable CW oscillator.

C505 is a factory adjustment which provides negative feedback for the oscillator. This adjustment is set to keep the grid current in the oscillator tube at a low level while still maintaining proper RF output over the entire range of the oscillator.

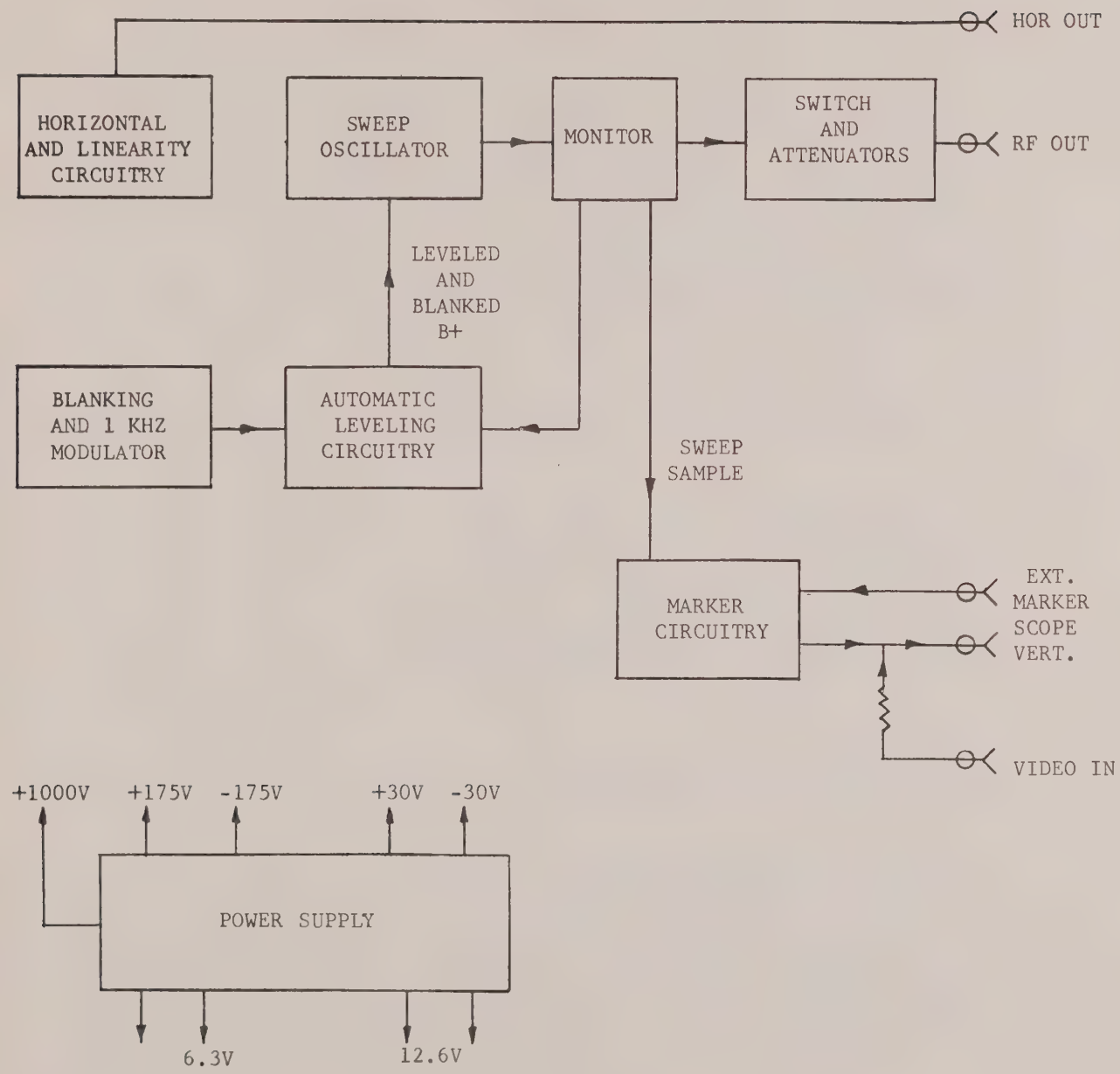


Figure 2-1
BLOCK DIAGRAM

2.4 BLANKING AND 1 KHZ MODULATOR

The function of the blanking circuit, shown in figure 6-2, is to turn off the sweep oscillator during retrace, thereby providing a zero voltage reference line in the Sweep and Modulated Sweep modes. Blanking is accomplished by removing B+ from the sweep oscillator during the sweep retrace time. The blanking signal is provided by taking 6.3v a.c. from terminal number 13 of the low voltage transformer and applying it to the base of Q200 after it has been properly phased by C102, C103, and R102. R102 is the blanking phase adjustment which insures that the blanking signal is always in proper phase with the horizontal sweep voltage and the wobbulator drive voltage.

Q200 is a squaring amplifier which is driven from cutoff to saturation by the 60 Hertz sinewave applied to its base. R202 sets the bias on Q200 to give equal on and off times.

The squared sinewave is then applied to the base of Q201 where it is amplified to approximately 160 volts. This square wave is then applied to the grid of V200 which is normally biased off. This large amplitude square wave drives V200 into saturation. The plate of V200 is connected to the grid of V202, a cathode follower. The high impedance at the grid of V202 results in V200 being saturated with only a small voltage drop from plate to cathode. The cathode of V200 is at approximately -160 volts, which is sufficient to cut off V202 which in turn cuts off V203 and V204, the power supply pass tubes.

The cathodes of V203 and V204 are connected directly to the plate of the oscillator tube, V500, so that when the pass tubes are cut off, the plate voltage on V500 is zero.

In the Mod. Sweep position of the function switch, the signal from the 1 KHZ multivibrator, consisting of Q202 and Q203 and their associated circuitry, is switched into the base of Q201 through CR200. When Q203 is saturated, the positive 60 Hertz blanking signal from Q200 is essentially shorted to ground through the low impedance of forward biased CR200 and saturated Q202. When Q202 is cut off, CR200 is back biased by the +30 volts on the collector of Q202, and the positive blanking signal from Q200 is applied to the base of Q201 as usual. When the 60 HZ blanking signal from Q200 is near zero (Q200 saturated), CR200 is always back biased, and the 1 KHZ square wave is blocked by CR200.

In the CW mode of operation, both the 1 KHZ square wave and 60 HZ blanking signal are switched off by the front panel function switch. In the Mod. CW mode, the 60 HZ signal is switched off and the 1 KHZ signal is applied to the base of Q201.

2.5 AUTOMATIC LEVELER CIRCUITRY

The automatic leveler circuitry, figure 6-3, consisting of differential amplifier leveler, Q400 and Q401, leveler amplifier V201, and their associated circuitry, insure a nearly constant or flat RF output from the oscillator by sampling the RF output, detecting, amplifying, reversing its polarity and feeding it back to the RF oscillator as a change in plate voltage. This is accomplished by rectifying and filtering the RF sample in the monitor by CR600, C600, C601, and R604. The negative envelope of the swept RF is applied to the base of Q401 where it is reversed in phase, amplified, and applied to the grid of Q401 where it is reversed in phase, amplified, and applied to the grid of the leveler amplifier, V201. It is again amplified, reversed in phase, and applied directly to the grid of the cathode follower V202, which controls the bias on the pass tubes, V203 and V204. Thus, a tendency for the RF oscillator to decrease its output is sensed by the leveler circuit and results in an increase in oscillator plate voltage which brings the RF output back up to its pre-set level.

The pre-set level at which the oscillator operates is determined by the other half of the differential amplifier, namely Q400, and the voltage dividers in its base circuit. R407 is a front panel control which allows the output of the oscillator to be attenuated.

As R407 is varied, the bias on Q400 changes. This change in conduction of Q400 is detected as a change in bias at the emitter of Q401 which results in a change in RF output.

Variable resistors R406 and R408 set the maximum and minimum output levels, respectively, as R407 is varied from one end of its travel to the other in the Sweep and Mod. Sweep modes. R405 and R409 perform the same functions in the CW and Mod. CW modes.

R403 is switched into the collector of Q401 when the Attenuator In-Out Switch is moved to the Attenuator In position. This resistance is set to reduce the power out of the oscillator to 1 watt average power. The turret attenuators have a power handling capability of only 1 watt. Instead of operating the oscillator at full output and dissipating the excess power in a fixed pad, the output of the oscillator is reduced electronically. This feature adds considerable operating life to the RF oscillator tubes.

2.6 HORIZONTAL GENERATOR AND LINEARITY CIRCUIT

The purpose of the horizontal generator and linearity circuit, shown in figure 6-4, is to provide a properly phased and shaped waveform at the horizontal output connector on the front panel to be used as the oscilloscope sweep signal.

A 6.3v sinewave is taken from terminal number 12 of the low voltage transformer and applied to the horizontal phase networks consisting of C100, C101, and R101. This phase shift network properly phases the horizontal sweep voltage with respect to the blanking and wobbulator drive voltages.

Q100 squares the sinewave. It is then integrated and shaped by the shaper network consisting of CR100, R107, R108, R109, and C106. R109 allows the shape of the waveform to be varied from an almost perfect triangular wave to an exponential waveform. This wide variation in available waveshapes makes it possible to align the unit for good display linearity.

The output waveform is taken from the emitter resistor, R111, of emitter follower Q101. R111 is the horizontal amplitude adjustment. Further compensation of the horizontal sweep voltage is accomplished by mixing the distorted triangular wave from R111 with a phase shifted sinewave from the junction of R100 and C104. The output waveform is taken from the center tap of R112 to the front panel connector on the instrument.

2.7 POWER SUPPLY, FIGURE 6-5

2.7.1 High Voltage Power Supply

This DC voltage supplies the B+ for the RF oscillator. High voltage stacked diodes, CR1 and CR2, are connected at the output of the high voltage transformer T1 as a full wave rectifier. The rectified AC is filtered by the choke input filter network consisting of L1, C1, and bleeder resistors R3, R4, and R5.

A filtered voltage of approximately 1000v d.c. is available at terminal number 29. A time delay relay (TD1) located in series with the primary windings of T1 insures proper warm-up time for the oscillator tube filaments before the high voltage is applied. The time delay of approximately 60 seconds begins when the function switch is moved to the standby position.

2.7.1 High Voltage Power Supply Continued

Fuse F1 (1A-3AG) affords overload protection to T1. C8 is placed across the high voltage AC contacts of TD1 to prevent arcing between the contacts when TD1 closes.

2.7.2 Low Voltage Power Supply

The regulated +30v and -30v supplies are generated from terminals 1 and 2 of T2. The +30v supply consists of a full wave rectified CR4 and CR6, a pi-shaped filter C4, C5, and R7, a 30v Zener diode for regulator D2, and bleeder resistor R11.

The corresponding components for the negative 30 volt supply are CR3, CR5, C2, C3, R6, D1, and R10.

The +175v and -175v supplies are each obtained from an unregulated half wave rectifier.

The positive 175v supply is obtained by rectifying half the sinewave present at terminal 4 of the secondary of T2. The remainder of this simple supply is filter capacitor C7 and bleeder resistor R9. The corresponding components for the -175v supply are CR7, C6, and R8. Fuse F2 (2A-3AG) protects transformer T2.

Transformers T1 and T2 are normally wired for 115v, 60 HZ operation. However, they may be rewired for 230 volt operation if desired. See Section 3 for instructions on rewiring the primaries.

2.8 MARKER SYSTEM

The unit is supplied with a "birdy-by-pass" marker system, figure 6-6, which has an external marker input plus provisions for six plug-in single frequency, SM, or harmonic, HM, markers.

In the marker system, a sample of the swept RF signal is mixed with the fundamental or a harmonic of the plug-in markers to produce beatnotes or birdies. These beatnotes or birdies are then amplified, shaped, and superimposed upon the demodulated video signal and applied to the vertical channel of the oscilloscope.

2.8 MARKER SYSTEM CONTINUED

Two sweep sample outputs are available from the monitor in order to minimize coupling between the marker signals. When an external CW source is being used as a marker, the signal is fed into a diode mixer, CR700, where it is mixed with the sweep sample from R601 in the monitor block. The signal is then fed to external marker amplifier, Q303, which is a high gain, common base amplifier. R306 is an internal size adjustment which allows the external marker system to accept a wide variation in signal source amplitudes.

Each plug-in marker receptacle has its own internal size adjustment. This allows each marker to have a different amplitude and gives quick and easy identification of the various markers on the oscilloscope display.

There are three internal marker amplifier circuits which amplify the six plug-in type markers with two markers being fed into each of the marker amplifiers.

The plug-in marker amplifiers and the external marker amplifier are coupled to a common birdy amplifier stage which includes the marker shaper circuit consisting of C311, C312, C313, L300, R325, and MARKER SHAPER Adjustment, R326. After amplification in Q304, the markers are applied to the MARKER SIZE Potentiometer, R330, which is a front panel adjustment.

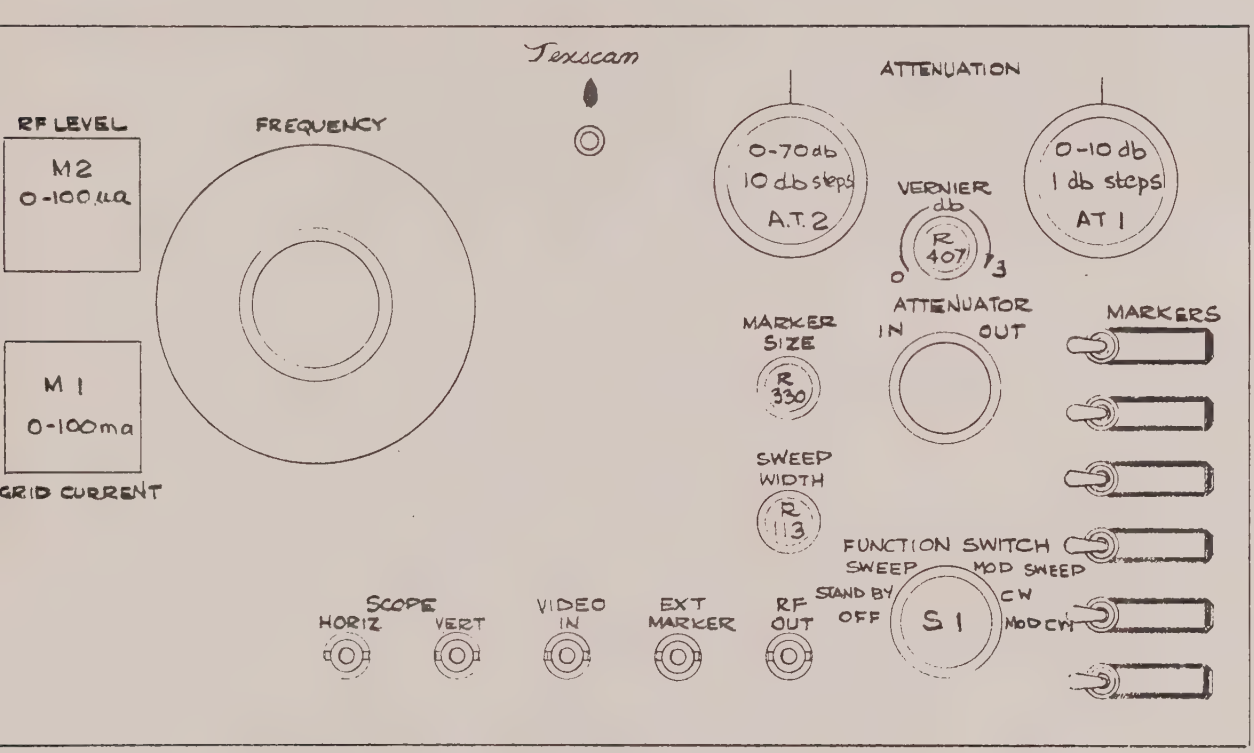


Figure 3-1
FRONT PANEL

SECTION 3

OPERATING INSTRUCTIONS

3.1 INTRODUCTION

The unit has four modes of operation: (1) Sweep, (2) Modulated Sweep, (3) CW, and (4) Modulated CW. The instrument is usually wired at the factory for operation on 115 volt power. If it is to be operated from a 230 volt AC source, then terminal board TB (figure 4-3), must be rewired as follows: (1) Remove the shorting wires between terminals 22 and 24, 23 and 25, 15 and 17, and 16 and 18, (2) Connect a shorting wire from terminal 23 to 24 and connect a shorting wire from terminal 16 to 17.

3.2 DESCRIPTION OF FRONT PANEL CONTROLS

A sketch of the front panel of the unit is shown in figure 3-1. Each of the controls and their functions are as follows:

3.2.1 Frequency Dial

Indicates the frequency of the oscillator in the CW modes and at minimum sweep width in the Sweep modes.

3.2.2 Attenuators (RA-50 and RA-51)

Turret attenuators which control the amplitude of the RF output in the Attenuator In position of the Attenuator In-Out Switch.

3.2.3 Attenuator In-Out Switch

Switches the peak RF output directly to the RF OUT connector in the Attenuator Out position. In the Attenuator In position, the RF output of the oscillator is reduced to 2 watts peak in the Sweep modes and 1 watt in the CW modes, and fed through the turret attenuators.

3.2.4 Vernier Attenuator

A continuously variable attenuator which reduces power out of the oscillator from 0 to 3 db in the Attenuator Out position of the Attenuator In-Out Switch. The vernier is inoperative in the Attenuator In position of the Attenuator In-Out Switch.

3.2.5 Marker Size

Adjusts the amplitude of the plug-in markers and the external marker.

3.2.6 Marker Switches

Switches the plug-in markers on and off.

3.2.7 Sweep Width

Adjusts the sweep width of the oscillator in the Sweep modes.

3.2.8 Function Switch

Selects any one of six modes of operation listed below:

1. AC Power Off
2. Standby
3. Sweep
4. Modulated Sweep
5. CW
6. Modulated CW

3.2.9 Meters

3.2.9.1 RF Level

Indicates rated output power when pointer is at mid-scale. Calibrated with vernier at 0 db and Attenuator In-Out Switch in Attenuator Out position.

3.2.9.2 Grid Current

Indicates excessive grid current being drawn by the oscillator tube when the pointer moves into the red portion of the scale.

3.2.10 RF Out

Connector for swept and CW output.

3.2.11 External Marker

Connector which allows an external signal source to be inserted to provide a marker on the video output.

3.2.12 Video In

The detected RF from the device under test is inserted here to superimpose the birdy markers on the detected signal.

3.2.13 Scope Vertical

The detected RF signal with the markers superimposed is available at this connector for connection to the oscilloscope vertical channel.

3.2.14 Scope Horizontal

The oscilloscope horizontal drive signal is available at this connector.

3.3 TYPICAL TEST SET UP

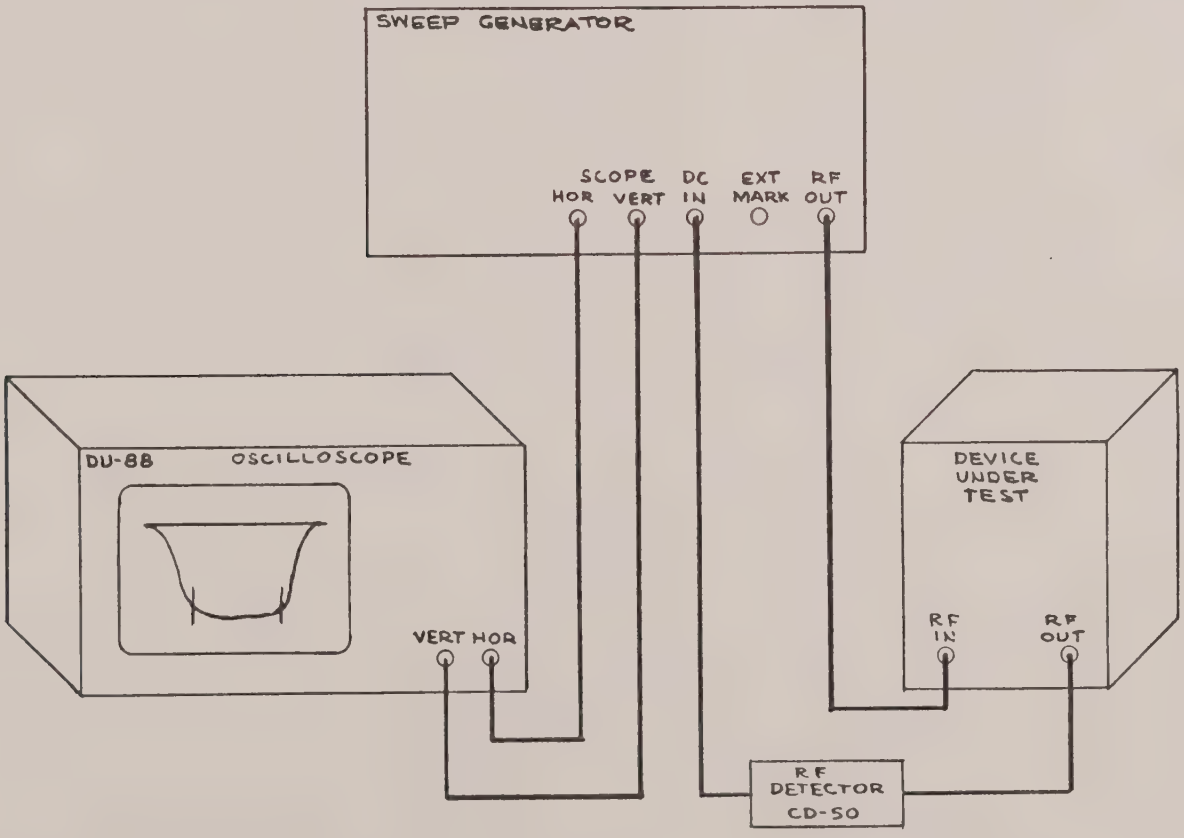


Figure 3-2

3.3 TYPICAL TEST SET UP CONTINUED

Make connections to the oscilloscope, device under test, detectors, and sweep generator as shown in figure 3-2. All connectors on the sweep generator are BNC type, and coaxial cable should be used for all connections to minimize hum, leakage, and spurious external signals.

The output impedance of the unit is 50 ohms so that for accurate display of bandpass responses, etc., tests should be conducted in a 50-ohm transmission line system. If the device under test is being designed to operate in other than a 50-ohm system, suitable matching devices should be used to convert the system impedance levels.

SECTION 4

ADJUSTMENT PROCEDURE

4.1 INTRODUCTION

The adjustments of this instrument can be accomplished with the following auxiliary test equipment - a DC oscilloscope (such as Hewlett-Packard Model 130), an RF power meter, and a multimeter. It is suggested that the reader familiarize himself with the unit's circuit operation by reading Section 2 before attempting alignment of the instrument.

Section 4.2 gives a discussion of the internal controls which require identification during alignment of the unit. Subsequent Sections 4.3 and 4.4 describe in detail the alignment procedure for each circuit. All internal controls are properly adjusted at the factory and only minor adjustments should be required in the field due to aging or changing of components.

4.2 EXPLANATION OF INTERNAL CONTROLS

Refer to figure 4-1 to identify the function of the following controls.

4.2.1 R101, Horizontal Phase Adjust

Adjusts the phase of the scope horizontal drive signal so that it is properly phased with the wobbulator drive.

4.2.2 R102, Blanking Phase Adjust

Adjusts the phase of the blanking signal so that it is properly phased with the wobbulator drive signal.

4.2.3 R103, Horizontal Width

Adjusts the width of the horizontal drive signal for equal trace and retrace times.

4.2.4 R109, Linearity

Adjusts the shape of the horizontal drive signal to give a linear sweep presentation at maximum sweep width.

4.2.5 R111, Horizontal Size

Adjusts the amplitude of the scope horizontal drive signal.

4.2.6 R113A, Linearity Compensation

Ganged with sweep width potentiometer to give a linear presentation as sweep width is adjusted from maximum to minimum. It is not an adjustment.

4.2.7 R202, Blanking Width

Adjusts the width of the blanking signal for equal on and off times.

4.2.8 R207, 1 KHZ Frequency

Adjusts the frequency of the 1 KHZ multivibrator.

4.2.9 R208, 1 KHZ Balance

Adjusts the 1 KHZ multivibrator for balanced operation.

4.2.10 R300-R305, Marker Size

Adjusts the amplitude of the plug-in markers - 1 through 6 respectively.

4.2.11 R306, External Marker Size

Adjusts the amplitude of the external marker.

4.2.12 R326, Marker Shaper

Adjusts the shape of the birdy markers.

4.2.13 R403, Fixed Level Adjust

Adjusts the leveler circuit to reduce the power output of the RF oscillator to 2 watts in Sweep modes and 1 watt in CW modes when the Attenuator In-Out Switch is in the Attenuator In position.

4.2.14 R405, Max. CW Level

Adjusts the maximum power output of the RF oscillator in the CW and Mod. CW modes when the front panel VERNIER Control is in the 0 db position.

4.2.15 R406, Max. Sweep Level

Adjusts the maximum power output of the RF oscillator in the Sweep and Mod. Sweep modes when the front panel VERNIER Control is in the 0 db position.

4.2.16 R408, Min. Sweep Level

Adjusts the minimum power out of the RF oscillator in the Sweep and Mod. Sweep modes when the front panel VERNIER Control is in the maximum attenuation position.

4.2.17 R409, Min. CW Level

Adjusts the minimum power out of the RF oscillator in the CW and Mod. CW modes when the front panel VERNIER Control is in the maximum attenuation position.

4.3 POWER SUPPLY

4.3.1 Low Voltage

There are no adjustments in the power supply. The positive and negative 175v supplies are unregulated and normally read 175 volts, ± 7 volts. The +30v and -30v supplies are each regulated by a 30 volt Zener diode and normally read 30 volts, ± 1 volt. If the low voltage readings are not within these limits, then D1 and/or D2 should be changed.

The test points for the low voltage supplies are as follows:

+30v,	± 1v	TP-33
-30v,	± 1v	TP-32
+175v,	± 7v	TP-35
-175v,	± 7v	TP-34

4.3.2 High Voltage

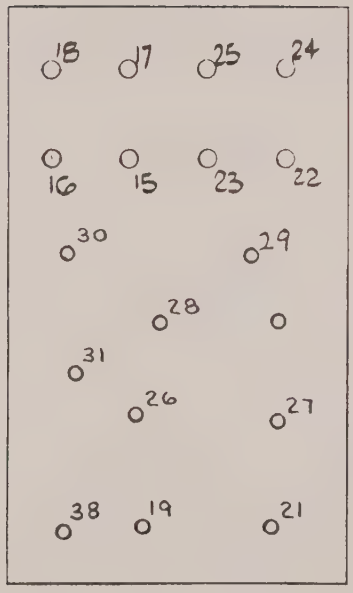
The high voltage supply is also unregulated and typically reads 1100 ± 100v at test point 29. See terminal board layout, TB1, figure 4-3.

4.4 BLANKING WIDTH AND BLANKING PHASE

4.4.1

Preset the following front panel controls to the positions indicated.

4.4.1.1 Function Switch to Sweep
4.4.1.2 Attenuator In-Out Switch to Attenuator In
4.4.1.3 Attenuation to 30 db
4.4.1.4 Vernier Attenuator to 0 (maximum counter clockwise)
4.4.1.5 Sweep Width to minimum (maximum counter clockwise)



HI VOLTAGE & TRANSFORMER
PRIMARY TERMINAL BOARD
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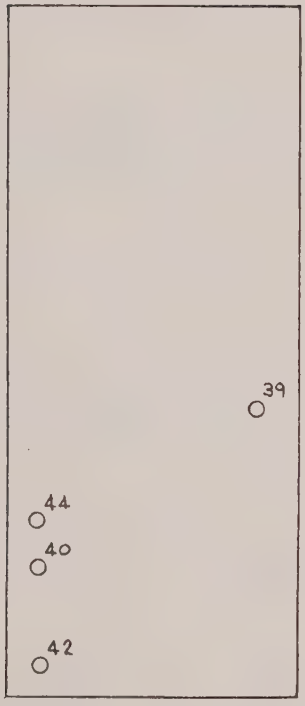


FILTER CAPACITOR
TERMINAL BOARD
T 82

Figure 4-3
Terminal Board Layouts

4.4.2

Connect the sweep generator to the oscilloscope as shown in the typical set up, figure 3-2, omitting the device under test.

4.4.3

Adjust the oscilloscope HORIZONTAL and VERTICAL Controls to obtain a display.

4.4.4

Adjust the BLANKING WIDTH, R202, and BLANKING PHASE, R102, until the display is rectangular. There is some interaction between these two adjustments, and it may be necessary to "rock" the adjustments until the proper display is obtained.

4.5 HORIZONTAL PHASE

4.5.1

Preset the front panel controls as in the Blanking Width and Phase Adjustment above with the exception of the SWEEP WIDTH Control which should be turned to maximum (clockwise).

4.5.2

Adjust the HORIZONTAL PHASE Control, R101, until the display becomes rectangular.

4.6 1 KHZ MULTIVIBRATOR ADJUSTMENT

4.6.1

Set the sweep generator front panel controls and oscilloscope controls as indicated below.

4.6.1.1

Set the Function Switch to Standby.

4.6.1.2

Set the oscilloscope SWEEP Control to Internal Sweep and the SWEEP TIME to 0.2msec per centimeter.

4.6.1.3

Set the VERTICAL DEFLECTION SENSITIVITY Control to 5v per centimeter.

4.6.2

Connect the scope vertical probe to TP204 and adjust the scope trigger level to synchronize the sweep.

4.6.3

Adjust the 1 KHZ BALANCE Control, R208, for equal on and off time.

4.6.4

Adjust the 1 KHZ FREQUENCY Control, R207, for a period of 1msec (1 KHZ). There is a slight interaction between these two adjustments and a small readjustment of R208 may be required.

4.7 SWEEP WIDTH ADJUSTMENT

4.7.1

Set the following front panel controls to the positions indicated below.

4.7.1.1 Function Switch to Sweep
4.7.1.2 Attenuator In-Out Switch to Attenuator In
4.7.1.3 Attenuation to 30 db
4.7.1.4 Frequency Dial to 20 MHZ
4.7.1.5 Sweep Width to maximum (clockwise)
4.7.1.6 Marker Size until the marker amplitude is suitable

4.7.2

Connect the HS-70 to the oscilloscope as indicated in the typical test set up, figure 3-2, but omit the device under test.

4.7.3

The best method to use when adjusting SWEEP WIDTH requires a 1 MHZ harmonic marker (HM-1); however, an alternate method will be described later.

4.7.4

If a 1 MHZ harmonic marker is used, adjust the SWEEP WIDTH LIMIT, R502, for 15% sweep width which is 3 MHZ at 20 MHZ center frequency. See the drawing below in figure 4-4.

Figure 4-4
SWEEP WIDTH DISPLAY

4.7.5

If a 1 MHZ harmonic marker is not available, a variable CW signal source may be used by inserting the signal at the external marker input on the front panel. Then R502 is adjusted until a 3 MHZ sweep is obtained as noted by varying the external signal source and measuring the frequency spread as the external marker moves from one end of the trace to the other.

4.8 LINEARITY AND HORIZONTAL SIZE

4.8.1

Set the front panel control and make connections to the scope as indicated in the section on Sweep Width Adjustment.

4.8.2

The display linearity is dependent upon the proper adjustment of several controls and interaction between these controls is noticeable. Therefore, it may be necessary to readjust several controls two or three times until 1.2:1 linearity is obtained over 80% of the sweep range at 20 MHZ center frequency with a 1 MHZ harmonic marker being used. Four birdy type markers will be observed if the sweep width is set at 15%. The scope horizontal gain should be adjusted until the display covers six centimeters. If the linearity was 1:1 then a marker would appear on every 1.5 cm scale graduation of the scope face. The linearity ratio is determined by dividing widest spacing between markers by the closest spacing between markers.

4.8.3

Adjust LINEARITY ADJUST, R109, HORIZONTAL WIDTH, R103, and HORIZONTAL PHASE ADJUST, R101, until a 1.2:1 linearity is obtained. (R103 should require only a very slight adjustment.)

4.8.4

Adjust HORIZONTAL SIZE, R111, until the horizontal output amplitude remains constant as the SWEEP WIDTH Control is rotated from maximum sweep to minimum sweep. A slight readjustment of R103 and R109 may be required after adjustment of R111 in order to realize the best linearity. The amplitude of the horizontal output should typically be 12-14 volts.

4.9 POWER LEVEL AND RF LEVEL METER CALIBRATION

4.9.1

Adjustment of the RF POWER LEVEL on the HS-70 is a critical adjustment in that misadjustment could result in damage to the RF oscillator tube, the monitor, and the turret attenuators. At the factory, a Hewlett-Packard 431B power meter and a 478A thermistor mount are used in this adjustment. External attenuation such as the Texscan FP series of fixed pads, totaling 30 db, are also required. If this equipment or its equivalent is not available, this adjustment should not be attempted.

4.9.2

Set the front panel controls as indicated below:

4.9.2.1 Attenuator In-Out Switch to Out
4.9.2.2 0-3 db Vernier to 3 db (clockwise)
4.9.2.3 Attenuation to 0 db
4.9.2.4 Function Switch to Sweep
4.9.2.5 Sweep Width to Minimum (counter clockwise)
4.9.2.6 Marker Size to Minimum (counter clockwise)

4.9.3

Set the power meter on the +10 mw range.

4.9.4

Connect the thermistor mount through the 30 db of external attenuation to the RF OUT Connector on the HS-70 sweep generator. It is extremely important that sufficient attenuation be placed between the RF OUT Connector and the thermistor mount of the power meter, for the high power output of the sweep generator will destroy the thermistor if this precaution is not taken.

4.9.5

Adjust R408, MINIMUM SWEEP LEVEL, until the power meter reads 1 mw. It may not be possible to obtain a 1 mw reading on the power meter if R406, MAXIMUM SWEEP LEVEL, is too far out of adjustment.

4.9.6

Rotate 0-3 db vernier to 0 db and adjust R406, MAXIMUM SWEEP LEVEL, until the power meter reads 2.0 mw. These two controls are interacting and repeated adjustment of R408 with the 0-3 db vernier at 3 db, and R406 with the 0-3 db vernier at 0 db are required. When these two adjustments are properly made, the 0-3 db VERNIER Control will cause the power meter reading to vary from 2.0 mw to 1 mw as the vernier is rotated from 0 to 3 db.

4.9.7

Rotate the 0-3 db vernier to 0 db.

4.9.8

Switch the Attenuator In-Out Switch to the In position.

4.9.9

Adjust R401, FIXED 3 DB ADJUST, until the power meter reads 1 mw.

4.9.10

Switch the Attenuator In-Out Switch to Out.

4.9.11

Adjust R504, SWEEP METER ADJUST, until the pointer on the RF LEVEL meter reads at the mid-scale mark.

4.9.12

Check the 0-3 db vernier for the 2.0 to 1 mw reading on the power meter and repeat steps 4.9.5 through 4.9.11 if necessary.

4.9.13

Set the 0-3 db VERNIER Control to 3 db.

4.9.14

Set the Attenuator In-Out Switch to the Out position.

4.9.15

Set the Function Switch to CW.

4.9.16

Adjust R409, MINIMUM CW LEVEL, until the power meter reads 1 mw.

4.9.17

Set the 0-3 db VERNIER Control to 0 db.

4.9.18

Adjust R405, MAXIMUM CW LEVEL, until the power meter reads 2.0 mw.

4.9.19

The R409 and R405 adjustments interact with each other and steps 4.9.16 through 4.9.18 may have to be repeated several times. When these two adjustments are properly made, the power meter should track from 2.0 mw to 1 mw as the front panel VERNIER Control is rotated from 0-3 db.

4.9.20

Set the Function Switch to Sweep.

4.9.21

Set the 0-3 db VERNIER Control to 0 db and check to see that the power meter reads 2 mw.

4.9.22

Readjust R504, if necessary, to put the pointer at mid-scale on the RF LEVEL meter.

4.9.23

Set the Function Switch to Mod. CW.

4.9.24

Adjust R505, MOD. SWEEP METER ADJUST, until the pointer is at mid-scale in RF LEVEL meter.

4.9.25

Note that the power meter should read 1 mw as the Function Switch is moved to the Mod. Sweep position.

4.9.26

Set the Function Switch to CW and readjust R506, CW METER ADJUST, until the pointer reads at mid-scale on the RF LEVEL meter.

4.9.27

Set the Function Switch to Mod. CW.

4.9.28

Adjust R507, MOD. CW METER ADJUST, until the pointer reads at mid-scale on the RF LEVEL meter.

4.9.29

Note that the power meter reads 1 mw when the Function Switch is in the Mod. CW position. If the power meter does not read 1 mw when the Function Switch is in the Mod. Sweep or Mod. CW position, it indicates that the balance of the 1 KHZ multivibrator is not adjusted properly, and R208, the 1 KHZ BALANCE ADJUST, should be adjusted until the power meter reads 1 mw.

SECTION 5

MAINTENANCE

5.1 INTRODUCTION

As in trouble shooting any electronic equipment, the best approach is to systemically attempt to isolate the problem to a particular circuit, and then a component, by the process of elimination. Before attempting to find any abnormal failure, it is suggested that the trouble shooting technician or engineer become familiar with the equipment by reading sections 2 and 3 of this manual. The following section 5.2 presents a trouble shooting chart which lists some of the more common failures. This chart should assist in finding or localizing the defective part. A VTVM and an oscilloscope should be sufficient tools in testing the unit.

5.2 TROUBLE SHOOTING CHART

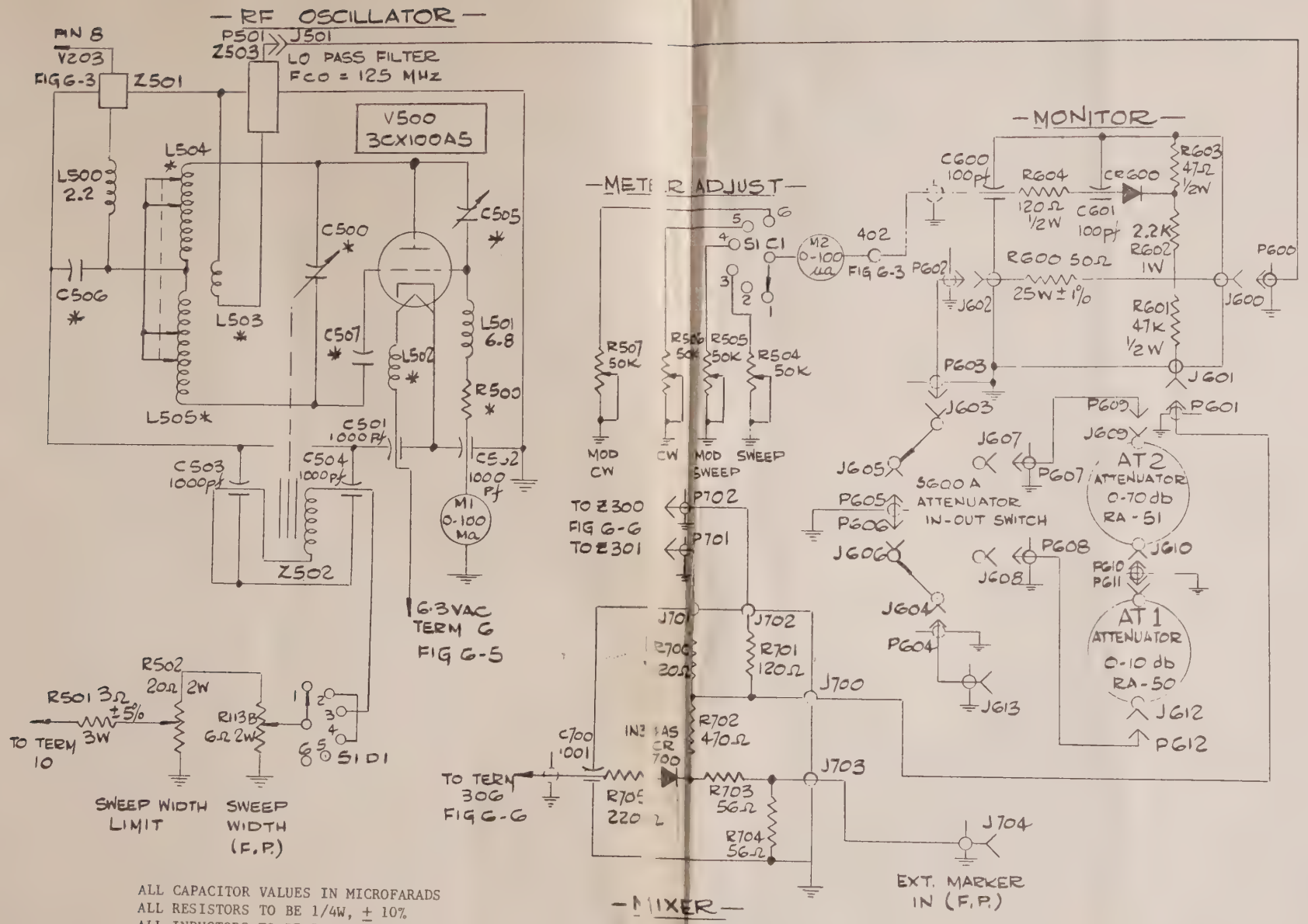
SYMPTOM	CHECK
5.2.1	
Power switch on but pilot light does not come on.	F1
5.2.2	
Pilot light lights, but no RF output after normal time delay.	F2, V500, and TD-1
5.2.3	
F2 blows when function switch is moved to Sweep position.	CR1, CR2, V203, V204, and short in high voltage supply
5.2.4	
+30 volts reads 0	CR4, CR6, and D2
5.2.5	
+30 volt supply out of tolerance.	D2
5.2.6	
-30 volt supply out of tolerance.	D1

SYMPTOM	CHECK
5.2.7	
-30 volts reads 0.	CR3, CR5, and D1
5.2.8	
+175 volts reads 0.	CR8
5.2.9	
-175 volts reads 0.	CR7
5.2.10	
Weak or no RF output.	V500
5.2.11	
High RF output-grid current meter in red region of scale.	CR600, Q400, Q401, and V201
5.2.12	
RF output in CW mode only.	Q200 and Q201
5.2.13	
RF output in Sweep and CW modes only	Q202 and Q203
5.2.14	
No scope horizontal drive signal	Q100 and Q101
5.2.15	
Internal markers okay; but no external marker.	Q303 and CR700
5.2.16	
External marker okay; but no internal markers.	Q300, Q301, Q302, and Q304

SYMPTOM	CHECK
5.2.17	
No external or internal markers	Q304
5.2.18	
RF level meter reads properly, but no RF output at the RF output connector.	Coaxial cables

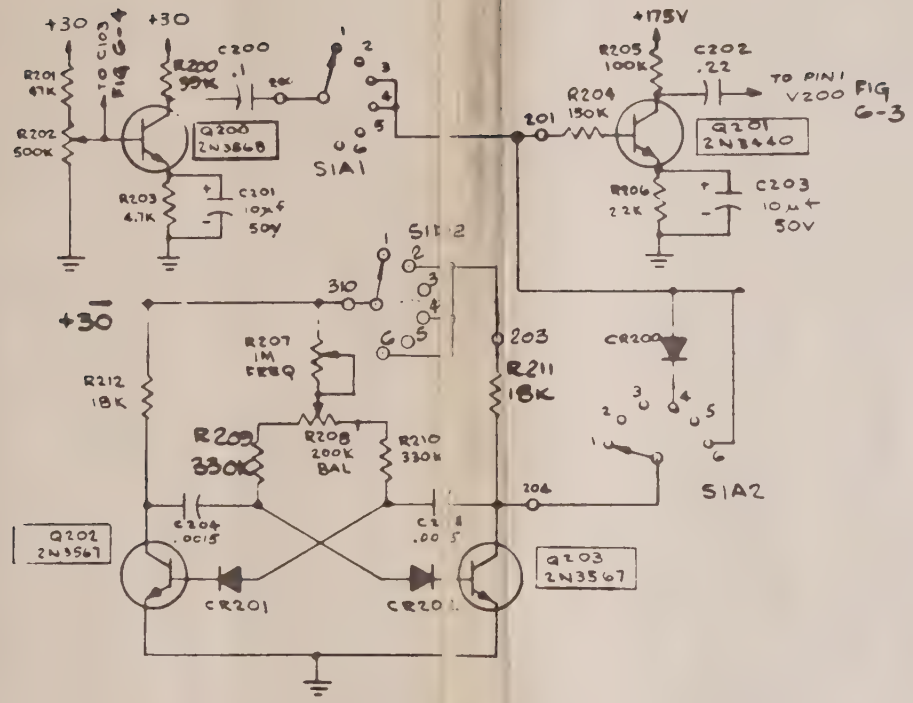
SECTION 6

DOCUMENTATION



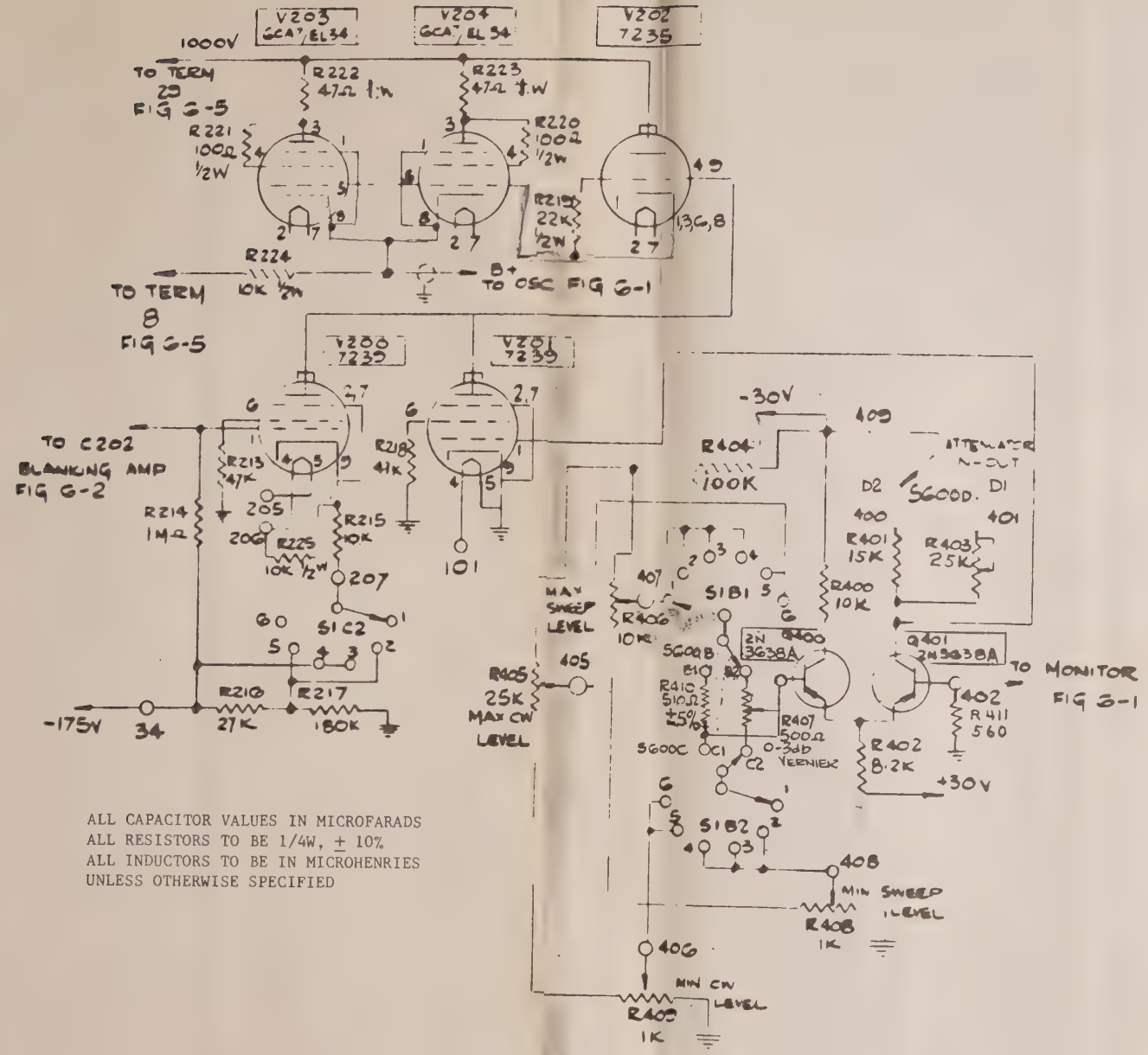
ALL CAPACITOR VALUES IN MICROFARADS
ALL RESISTORS TO BE 1/4W, ± 10%
ALL INDUCTORS TO BE IN MICROHENRIES
UNLESS OTHERWISE SPECIFIED

FIGURE 6-1
RF OSCILLATOR
6-1



ALL CAPACITOR VALUES IN MICROFARADS
ALL RESISTORS TO BE 1/4W, ± 10%
ALL INDUCTORS TO BE IN MICROHENRIES
UNLESS OTHERWISE SPECIFIED

FIGURE 6-2
BLANKING AND 1 KHZ MODULATOR
6-2



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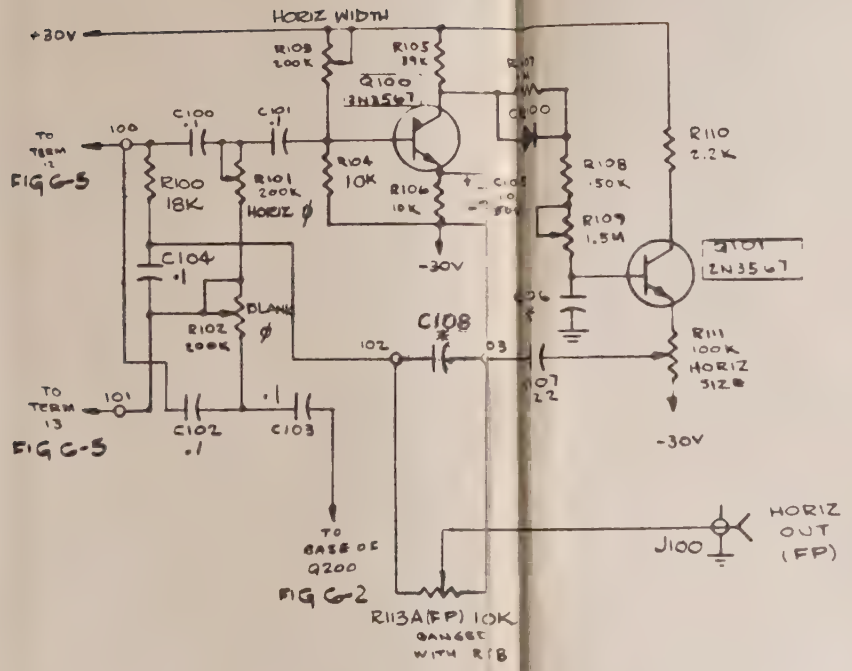
UNLESS OTHERWISE SPECIFIED

FIGURE 6-3
AUTOMATIC LEVEL
6-3



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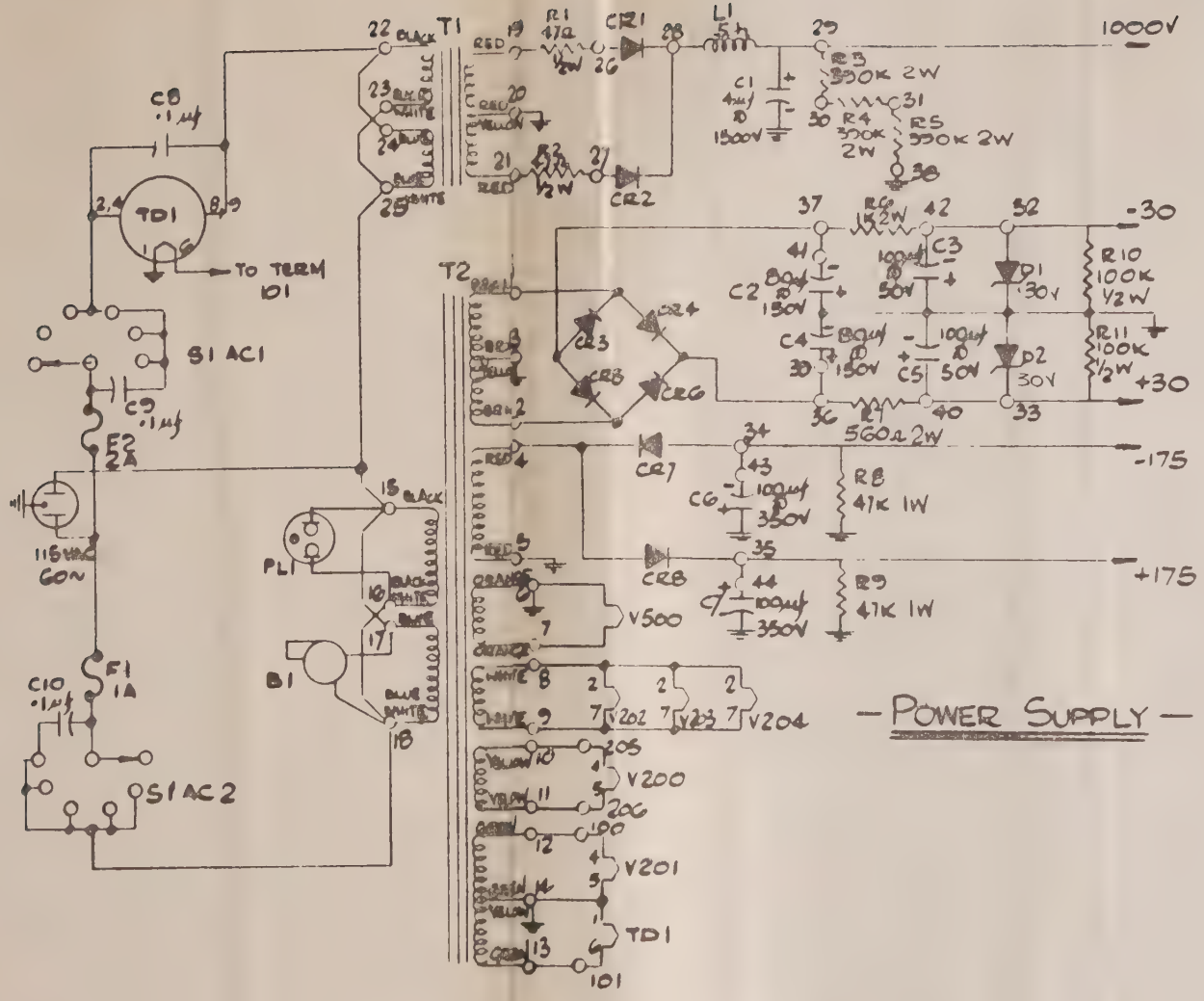
ALL RESISTORS TO BE ./4W ± 10%
ALL INDUCTORS TO BE IN MICROHENRIES
UNLESS OTHERWISE SPECIFIED

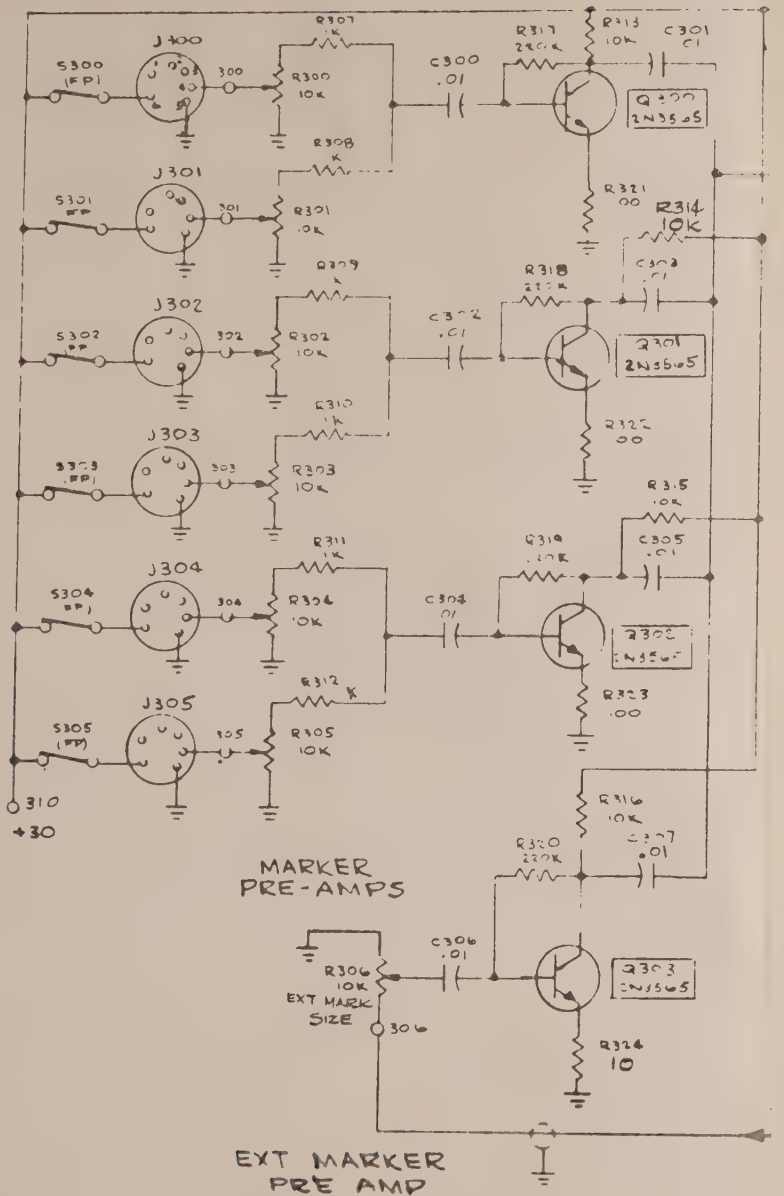
FIGURE 6-4
HORIZONTAL GENERATOR AND LINEARITY
6-4

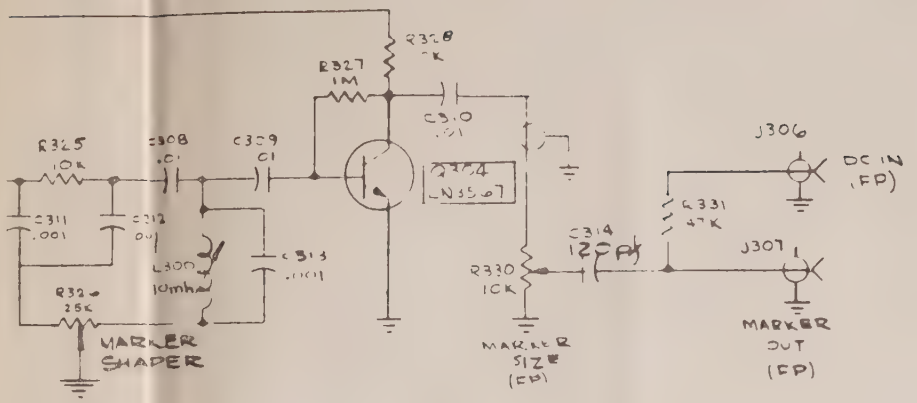


— POWER SUPPLY —

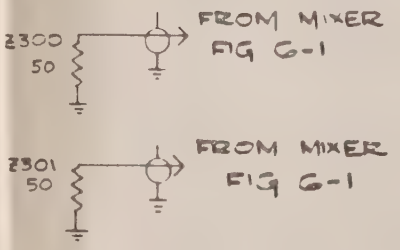
ALL CAPACITOR VALUES IN MICROFARADS
ALL RESISTORS TO BE 1/4W, ± 10%
ALL INDUCTORS TO BE IN MICROHENRIES
UNLESS OTERWISE SPECIFIED

FIGURE 6
POWER SUPP
6





BIRDY AMPLIFIER & SHAPER



MARKER TERMINATIONS

ALL CAPACITOR VALUES IN MICROFARADS
ALL RESISTORS TO BE 1/4W, ± 10%
ALL INDUCTORS TO BE IN MICROHENRIES
UNLESS OTHERWISE SPECIFIED

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
AT 1	C200-014	Attenuator - 0-10 db	Texscan RA-50
AT 2	C200-018	Attenuator - 0-70 db	Texscan RA-51
B1	027-001	Fan - Blower	Howard Industries 8529
C1	012-040	Capacitor, Fixed, 4uf, @ 1500v	Texscan
C2	012-029	Capacitor, Fixed, 80uf, @ 150v	Cornell Dubilier BR80-150
C3	012-042	Capacitor, Fixed, 100uf, @ 50v	Cornell Dubilier BR100-50
C4	012-029	Capacitor, Fixed, 80uf, @ 150v	Cornell Dubilier BR80-150
C5	012-042	Capacitor, Fixed, 100uf, @ 50v	Cornell Dubilier BR100-50
C6	012-062	Capacitor, Fixed, 100uf, @ 350v	Cornell Dubilier BR100-350
C7	012-062	Capacitor, Fixed, 100uf, @ 350v	Cornell Dubilier BR100-350
C8	012-053	Capacitor, Fixed, 0.1uf, @ 600v	Sprague 220P6PS-P10
C9	012-053	Capacitor, Fixed, 0.1uf, @ 600v	Sprague 220P6PS-P10
C10	012-053	Capacitor, Fixed, 0.1uf, @ 600v	Sprague 220P6PS-P10
C100	012-023	Capacitor, Fixed, 0.1uf, @ 200v	Standard Condenser MBA200
C101	012-023	Capacitor, Fixed, 0.1uf, @ 200v	Standard Condenser MBA200
C102	012-023	Capacitor, Fixed, 0.1uf, @ 200v	Standard Condenser MBA200
C103	012-023	Capacitor, Fixed, 0.1uf, @ 200v	Standard Condenser MBA200
C104	012-023	Capacitor, Fixed, 0.1uf, @ 200v	Standard Condenser MBA200
C105	012-025	Capacitor, Fixed, 10uf, @ 50v	Cornell Dubilier ECSP10-50
C106		Factory selected value	
C107	012-024	Capacitor, Fixed, 0.22uf, @ 200v	Standard Condenser MBA200
C108		Factory selected value	
C200	012-023	Capacitor, Fixed, 0.1uf, @ 200v	Standard Condenser MBA200
C201	012-025	Capacitor, Fixed, 10uf, @ 50v	Cornell Dubilier ECSP10-50
C202	012-072	Capacitor, Fixed, 0.22uf, @ 400v	Standard Condenser MBA400
C203	012-025	Capacitor, Fixed, 10uf, @ 50v	Cornell Dubilier ECSP10-50
C204	012-069	Capacitor, Fixed, 0.0015uf, @ 100v	Sprague 225P15291
C205	012-069	Capacitor, Fixed, 0.0015uf, @ 100v	Sprague 225P15291
C300	012-050	Capacitor, Fixed, 0.01uf, @ 100v	RMC TA.01
C301	012-050	Capacitor, Fixed, 0.01uf, @ 100v	RMC TA.01
C302	012-050	Capacitor, Fixed, 0.01uf, @ 100v	RMC TA.01
C303	012-050	Capacitor, Fixed, 0.01uf, @ 100v	RMC TA.01
C304	012-050	Capacitor, Fixed, 0.01uf, @ 100v	RMC TA.01
C305	012-050	Capacitor, Fixed, 0.01uf, @ 100v	RMC TA.01
C306	012-050	Capacitor, Fixed, 0.01uf, @ 100v	RMC TA.01
C307	012-050	Capacitor, Fixed, 0.01uf, @ 100v	RMC TA.01

REF. NO.	STOCK NO.		
C308	012-050	Capacitor, Fixed, 0.01uf, @ 100v	RMC TA.01
C309	012-050	Capacitor, Fixed, 0.01uf, @ 100v	RMC TA.01
C310	012-050	Capacitor, Fixed, 0.01uf, @ 100v	RMC TA.01
C311	012-009	Capacitor, Fixed, 0.001uf, @ 500v	RMC SM.001
C312	012-009	Capacitor, Fixed, 0.001uf, @ 500v	RMC SM.001
C313	012-009	Capacitor, Fixed, 0.001uf, @ 500v	RMC SM.001
C314	012-013	Capacitor, Fixed, 120pf	RMC C120, N-1500
C500		Factory selected value	
C501	012-046	Capacitor, Fixed, 1000pf	Erie 2443008X5U0102M
C502	012-046	Capacitor, Fixed, 1000pf	Erie 2443008X5U0102M
C503	012-045	Capacitor, Fixed, 1000pf	Erie 669-011
C504	012-045	Capacitor, Fixed, 1000pf	Erie 669-011
C505		Factory selected value	
C506		Factory selected value	
C507		Factory selected value	
C600	012-044	Capacitor, Fixed, 100pf	Erie 666-003
C601	012-044	Capacitor, Fixed, 100pf	Erie 666-003
C700	012-001	Capacitor, Fixed, 1000pf	Allen Bradley FA5C-GMV
CR1	025-030	Diode, HVC400	Sarkes Tarzian HVC400
CR2	025-030	Diode, HVC400	Sarkes Tarzian HVC400
CR3	025-007	Diode, A13D2	General Electric A13D2
CR4	025-007	Diode, A13D2	General Electric A13D2
CR5	025-007	Diode, A13D2	General Electric A13D2
CR6	025-007	Diode, A13D2	General Electric A13D2
CR7	025-007	Diode, A13D2	General Electric A13D2
CR8	025-007	Diode, A13D2	General Electric A13D2
CR100	025-007	Diode, A13D2	General Electric A13D2
CR200	025-007	Diode, A13D2	General Electric A13D2
CR201	025-007	Diode, A13D2	General Electric A13D2
CR202	025-007	Diode, A13D2	General Electric A13D2
CR600	025-002	Diode, 1N82A	Sylvania 1N82A
CR700	025-004	Diode, 1N34AS	Sylvania 1N34AS
D1	025-013	Diode, Zener, 2VR30A	Sarkes Tarzian 2VR30A
D2	025-013	Diode, Zener, 2VR30A	Sarkes Tarzian 2VR30A
F1	034-001	Fuse, 3AG, 1A	Littelfuse 312001
F2	034-002	Fuse, 3AG, 2A	Littelfuse 312002

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
J100	020-017	Connector, RF	Star 5070
J300	054-003	Socket, 6 Pin	Cinch Jones 201-41-06-243
J301	054-003	Socket, 6 Pin	Cinch Jones 201-41-06-243
J302	054-003	Socket, 6 Pin	Cinch Jones 201-41-06-243
J303	054-003	Socket, 6 Pin	Cinch Jones 201-41-06-243
J304	054-003	Socket, 6 Pin	Cinch Jones 201-41-06-243
J305	054-003	Socket, 6 Pin	Cinch Jones 201-41-06-243
J306	020-017	Connector, RF	Star 5070
J307	020-017	Connector, RF	Star 5070
J501	020-050	Connector, RF	Star UG89C/U
J600	020-030	Connector, RF	Star UG185/U
J601	020-030	Connector, RF	Star UG185/U
J602	020-030	Connector, RF	Star UG185/U
J613	020-017	Connector, RF	Star 5070
J700	020-018	Connector, RF	Star MX1684/U
J701	020-018	Connector, RF	Star MX1684/U
J702	020-018	Connector, RF	Star MX1684/U
J703	020-018	Connector, RF	Star MX1684/U
J704	020-017	Connector, RF	Star 5070
L1	035-006	Inductor, 5h	American Magnetics AM3290
L300	035-008	Inductor, 10mh	Central Coil H-0813-15
L500	035-002	Inductor, 2.2uh	Jeffers 4436-4K
L501	035-009	Inductor, 6.8uh	Wilco 215-11
L502		Factory selected value	
L503		Factory selected value	
L504		Factory selected value	
L505		Factory selected value	
M1	043-001	Meter, 0-100 ma	Texscan
M2	043-002	Meter, 0-100 ua	Texscan
P600	020-021	Connector, RF Plug	Star UG88C/U
P601	020-021	Connector, RF Plug	Star UG88C/U
P602	020-021	Connector, RF Plug	Star UG88C/U
P603	020-021	Connector, RF Plug	Star UG88C/U
P604	020-021	Connector, RF Plug	Star UG88C/U

REF. NO.	STOCK NO.		
P605	020-021	Connector, RF Plug	Star UG88C/U
P606	020-021	Connector, RF Plug	Star UG88C/U
P607	020-021	Connector, RF Plug	Star UG88C/U
P608	020-021	Connector, RF Plug	Star UG88C/U
P609	020-021	Connector, RF Plug	Star UG88C/U
P610	020-021	Connector, RF Plug	Star UG88C/U
P611	020-021	Connector, RF Plug	Star UG88C/U
P612	020-021	Connector, RF Plug	Star UG88C/U
P701	020-021	Connector, RF Plug	Star UG88C/U
P702	020-021	Connector, RF Plug	Star UG88C/U
PL1	011-001	Bulb - Pilot Light	Drake 6063-634
Q100	062-003	Transistor, 2N3567	Fairchild 2N3567
Q101	062-003	Transistor, 2N3567	Fairchild 2N3567
Q200	062-015	Transistor, 2N3568	Fairchild 2N3568
Q201	062-008	Transistor, 2N3440	RCA 2N3440
Q202	062-003	Transistor, 2N3567	Fairchild 2N3567
Q203	062-003	Transistor, 2N3567	Fairchild 2N3567
Q300	062-002	Transistor, 2N3565	Fairchild 2N3565
Q301	062-002	Transistor, 2N3565	Fairchild 2N3565
Q302	062-002	Transistor, 2N3565	Fairchild 2N3565
Q303	062-002	Transistor, 2N3565	Fairchild 2N3565
Q304	062-003	Transistor, 2N3567	Fairchild 2N3567
Q400	062-010	Transistor, 2N3638A	Fairchild 2N3638A
Q401	062-010	Transistor, 2N3638A	Fairchild 2N3638A
R1	046-054	Resistor, Fixed, 47 ohm, ½W, ± 10%	Allen Bradley
R2	046-054	Resistor, Fixed, 47 ohm, ½W, ± 10%	Allen Bradley
R3	046-819	Resistor, Fixed, 390K ohm, 2W, ± 10%	Allen Bradley
R4	046-819	Resistor, Fixed, 390K ohm, 2W, ± 10%	Allen Bradley
R5	046-819	Resistor, Fixed, 390K ohm, 2W, ± 10%	Allen Bradley
R6	046-710	Resistor, Fixed, 1K ohm, 2W, ± 10%	Allen Bradley
R7	046-700	Resistor, Fixed, 560 ohm, 2W, ± 10%	Allen Bradley
R8	046-480	Resistor, Fixed, 47K ohm, 1W, ± 10%	Allen Bradley
R9	046-480	Resistor, Fixed, 47K ohm, 1W, ± 10%	Allen Bradley
R10	046-194	Resistor, Fixed, 100K ohm, ½W, ± 10%	Allen Bradley
R11	046-194	Resistor, Fixed, 100K ohm, ½W, ± 10%	Allen Bradley
R100	045-763	Resistor, Fixed, 18K ohm, ¼W, ± 10%	Allen Bradley
R101	048-031	Resistor, Variable, 200K ohm	Texscan
R102	048-031	Resistor, Variable, 200K ohm	Texscan
R103	048-031	Resistor, Variable, 200K ohm	Texscan

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
R104	045-752	Resistor, Fixed, 10K ohm, ½W, ± 10%	Allen Bradley
R105	045-777	Resistor, Fixed, 39K ohm, ½W, ± 10%	Allen Bradley
R106	045-752	Resistor, Fixed, 10K ohm, ½W, ± 10%	Allen Bradley
R107	045-836	Resistor, Fixed, 1M ohm, ½W, ± 10%	Allen Bradley
R108	045-801	Resistor, Fixed, 150K ohm, ½W, ± 10%	Allen Bradley
R109	048-033	Resistor, Variable, 1.5M ohm	Texscan
R110	045-724	Resistor, Fixed, 2.2K ohm, ½W, ± 10%	Allen Bradley
R111	048-027	Resistor, Variable, 100K ohm	Texscan
R112		Not used	
R113A	048-039	Resistor, Variable, 100K ohm	Texscan
R113B	048-039	Resistor, Variable, 6 ohm	Texscan
R200	045-777	Resistor, Fixed. 39K ohm, ½W, ± 10%	Allen Bradley
R201	045-780	Resistor, Fixed, 47K ohm, ½W, ± 10%	Allen Bradley
R202	048-028	Resistor, Variable, 500K ohm	Texscan
R203	045-738	Resistor, Fixed, 4.7K ohm, ½W, ± 10%	Allen Bradley
R204	045-801	Resistor, Fixed, 150K ohm, ½W, ± 10%	Allen Bradley
R205	045-794	Resistor, Fixed, 100K ohm, ½W, ± 10%	Allen Bradley
R206	045-724	Resistor, Fixed, 2.2K ohm, ½W, ± 10%	Allen Bradley
R207	048-032	Resistor, Variable, 1M ohm	Texscan
R208	048-031	Resistor, Variable, 200K ohm	Texscan
R209	045-815	Resistor, Fixed, 330K ohm, ½W, ± 10%	Allen Bradley
R210	045-815	kesistor, Fixed, 330K ohm, ½W, ± 10%	Allen Bradley
R211	045-763	Resistor, Fixed, 18K ohm, ½W, ± 10%	Allen Bradley
R212	045-763	Resistor, Fixed, 18K ohm, ½W, ± 10%	Allen Bradley
R213	045-780	Resistor, Fixed, 47K ohm, ½W, ± 10%	Allen Bradley
R214	045-836	Resistor, Fixed, 1M ohm, ½W, ± 10%	Allen Bradley
R215	045-752	Resistor, Fixed, 10K ohm, ½W, ± 10%	Allen Bradley
R216	045-770	Resistor, Fixed, 27K ohm, ½W, ± 10%	Allen Bradley
R217	045-805	Resistor, Fixed, 180K ohm, ½W, ± 10%	Allen Bradley
R218	045-780	Resistor, Fixed, 47K ohm, ½W, ± 10%	Allen Bradley
R219	046-166	Resistor, Fixed, 22K ohm, ½W, ± 10%	Allen Bradley
R220	046-068	Resistor, Fixed, 100 ohm, ½W, ± 10%	Allen Bradley
R221	046-068	Resistor, Fixed, 100 ohm, ½W, ± 10%	Allen Bradley
R222	046-354	Resistor, Fixed, 47 ohm, 1W, ± 10%	Allen Bradley

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
R223	046-354	Resistor, Fixed, 47 ohm, 1W, ± 10%	Allen Bradley
R224	046-152	Resistor, Fixed, 10K ohm, ½W, ± 10%	Allen Bradley
R225	046-152	Resistor, Fixed, 10K ohm, ½W, ± 10%	Allen Bradley
R300	048-025	Resistor, Variable, 10K ohm	Texscan
R301	048-025	Resistor, Variable, 10K ohm	Texscan
R302	048-025	Resistor, Variable, 10K ohm	Texscan
R303	048-025	Resistor, Variable, 10K ohm	Texscan
R304	048-025	Resistor, Variable, 10K ohm	Texscan
R305	048-025	Resistor, Variable, 10K ohm	Texscan
R306	048-025	Resistor, Variable, 10K ohm	Texscan
R307	045-710	Resistor, Fixed, 1K ohm, ¼W, ± 10%	Allen Bradley
R308	045-710	Resistor, Fixed, 1K ohm, ¼W, ± 10%	Allen Bradley
R309	045-710	Resistor, Fixed, 1K ohm, ¼W, ± 10%	Allen Bradley
R310	045-710	Resistor, Fixed, 1K ohm, ¼W, ± 10%	Allen Bradley
R311	045-710	Resistor, Fixed, 1K ohm, ¼W, ± 10%	Allen Bradley
R312	045-710	Resistor, Fixed, 1K ohm, ¼W, ± 10%	Allen Bradley
R313	045-752	Resistor, Fixed, 10K ohm, ¼W, ± 10%	Allen Bradley
R314	045-752	Resistor, Fixed, 10K ohm, ¼W, ± 10%	Allen Bradley
R315	045-752	Resistor, Fixed, 10K ohm, ¼W, ± 10%	Allen Bradley
R316	045-752	Resistor, Fixed, 10K ohm, ¼W, ± 10%	Allen Bradley
R317	045-808	Resistor, Fixed, 220K ohm, ¼W, ± 10%	Allen Bradley
R318	045-808	Resistor, Fixed, 220K ohm, ¼W, ± 10%	Allen Bradley
R319	045-808	Resistor, Fixed, 220K ohm, ¼W, ± 10%	Allen Bradley
R320	045-808	Resistor, Fixed, 220K ohm, ¼W, ± 10%	Allen Bradley
R321	045-668	Resistor, Fixed, 100 ohm, ¼W, ± 10%	Allen Bradley
R322	045-668	Resistor, Fixed, 100 ohm, ¼W, ± 10%	Allen Bradley
R323	045-668	Resistor, Fixed, 100 ohm, ¼W, ± 10%	Allen Bradley
R324	045-626	Resistor, Fixed, 10 ohm, ¼W, ± 10%	Allen Bradley
R325	045-752	Resistor, Fixed, 10K ohm, ¼W, ± 10%	Allen Bradley
R326	048-026	Resistor, Variable, 25K ohm	Texscan
R327	045-836	Resistor, Fixed, 1M ohm, ¼W, ± 10%	Allen Bradley
R328	045-752	Resistor, Fixed, 10K ohm, ¼W, ± 10%	Allen Bradley
R329		Not used	
R330	048-042	Resistor, Variable, 10K ohm	Texscan
R331	046-180	Resistor, Fixed, 47K ohm, ½W, ± 10%	Allen Bradley

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
R400	045-752	Resistor, Fixed, 10K ohm, ½W, ± 10%	Allen Bradley
R401	045-759	Resistor, Fixed, 15K ohm, ½W, ± 10%	Allen Bradley
R402	045-749	Resistor, Fixed, 8.2K ohm, ½W, ± 10%	Allen Bradley
R403	048-026	Resistor, Variable, 25K ohm	Texscan
R404	045-794	Resistor, Fixed, 100K ohm, ½W, ± 10%	Allen Bradley
R405	048-026	Resistor, Variable, 25K ohm	Texscan
R406	048-025	Resistor, Variable, 10K ohm	Texscan
R407	048-041	Resistor, Variable, 500 ohm	Texscan
R408	048-030	Resistor, Variable, 1K ohm	Texscan
R409	048-030	Resistor, Variable, 1K ohm	Texscan
R410	045-698	Resistor, Fixed, 510 ohm, ½W, ± 5%	Allen Bradley
R411	045-700	Resistor, Fixed, 560 ohm, ½W, ± 10%	Allen Bradley
R500		Factory selected value	
R501	047-075	Resistor, Fixed, 3 ohm, 3W, ± 5%	Sprague 242E-030-5
R502	048-040	Resistor, Variable, 20 ohm	Texscan
R503		Not used	
R504	048-038	Resistor, Variable, 50K ohm	Texscan
R505	048-038	Resistor, Variable, 50K ohm	Texscan
R506	048-038	Resistor, Variable, 50K ohm	Texscan
R507	048-038	Resistor, Variable, 50K ohm	Texscan
R508		Not used	
R600	047-078	Resistor, Fixed, 50 ohm, 25W, ± 1%	Pyrofilm 25DR750P
R601	046-180	Resistor, Fixed, 47K ohm, ½W, ± 10%	Allen Bradley
R602	046-424	Resistor, Fixed, 2.2K ohm, 1W, ± 10%	Allen Bradley
R603	046-054	Resistor, Fixed, 47 ohm, ½W, ± 10%	Allen Bradley
R604	046-072	Resistor, Fixed, 120 ohm, ½W, ± 10%	Allen Bradley
R700	045-672	Resistor, Fixed, 120 ohm, ½W, ± 10%	Allen Bradley
R701	045-672	Resistor, Fixed, 120 ohm, ½W, ± 10%	Allen Bradley
R702	045-696	Resistor, Fixed, 470 ohm, ½W, ± 10%	Allen Bradley
R703	045-658	Resistor, Fixed, 56 ohm, ½W, ± 10%	Allen Bradley
R704	045-658	Resistor, Fixed, 56 ohm, ½W, ± 10%	Allen Bradley
R705	045-682	Resistor, Fixed, 220 ohm, ½W, ± 10%	Allen Bradley
S1	057-009	Switch	Texscan
S300	057-004	Switch, SPST	Cutler Hammer 8280K16
S301	057-004	Switch, SPST	Cutler Hammer 8280K16
S302	057-004	Switch, SPST	Cutler Hammer 8280K16
S303	057-004	Switch, SPST	Cutler Hammer 8280K16

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION	MFG., MFG. PART NO.
S304	057-004	Switch, SPST	Cutler Hammer 8280K16
S305	057-004	Switch, SPST	Cutler Hammer 8280K16
S600		Switch - Coaxial and DC	Texscan
T1	061-007	Transformer - H.V.	American Magnetics AM3287
T2	061-006	Transformer - L.V.	American Magnetics AM3317
TD1	063-005	Tube - Time Delay 6N060T	Amperite 6N060T
V200	063-003	Tube, 7239	General Electric 7239
V201	063-003	Tube, 7239	General Electric 7239
V202	063-006	Tube, 7235	National Union 7235
V203	063-002	Tube, EL34/6CA7	Amperex EL34/6CA7
V204	063-002	Tube, EL34/6CA7	Amperex EL34/6CA7
V500	063-004	Tube, 3CX100A5	General Electric 3CX100A5
Z1	019-004	Conductor, Line Cord	Alpha Wire 615
Z300	A200-005	Termination, Jack	Texscan TF-50
Z301	A200-005	Termination, Jack	Texscan TF-50
Z501	012-078	Filter Feed-thru	Erie 1270-001
Z502	B204-001	Wobbulator	Texscan
Z503	B204-036-03	Filter, 125 MHZ Low Pass	Texscan